



Electrokinetically Enhanced Delivery for ERD Remediation of Chlorinated Ethenes in a Fractured Limestone Aquifer

Broholm, Mette Martina; Hyldegaard, Bente Højlund; With Nedergaard, Lærke; Barrett Sørensen, Mie; Riis, Charlotte; Ottosen, Lisbeth M.

Publication date:
2015

Document Version
Peer reviewed version

[Link back to DTU Orbit](#)

Citation (APA):
Broholm, M. M., Hyldegaard, B. H., With Nedergaard, L., Barrett Sørensen, M., Riis, C., & Ottosen, L. M. (2015). *Electrokinetically Enhanced Delivery for ERD Remediation of Chlorinated Ethenes in a Fractured Limestone Aquifer*. Abstract from 2015 NGWA Conference on Groundwater in Fractured Rock, Burlington, Vermont, United States.

General rights

Copyright and moral rights for the publications made accessible in the public portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

- Users may download and print one copy of any publication from the public portal for the purpose of private study or research.
- You may not further distribute the material or use it for any profit-making activity or commercial gain
- You may freely distribute the URL identifying the publication in the public portal

If you believe that this document breaches copyright please contact us providing details, and we will remove access to the work immediately and investigate your claim.

2015 NGWA Conference on Groundwater in Fractured Rock September 28 - 29, 2015

Electrokinetically Enhanced Delivery for ERD Remediation of Chlorinated Ethenes in a Fractured Limestone Aquifer

Tuesday, September 29, 2015: 8:50 a.m.

Mette M. Broholm , Department of Environmental Engineering, Technical University of Denmark, Kgs. Lyngby, Denmark

Bente H. Hansen , DTU Environment, Technical University of Denmark, Kgs. Lyngby, Denmark

Lærke W. Nedergaard , DTU Environment, Technical University of Denmark, Kgs Lyngby, Denmark

Mie B. Sørensen , DTU Environment, Technical University of Denmark, Kgs Lyngby, Denmark

Charlotte Riis, M.Sc , NIRAS, Allerød, Denmark

Lisbeth Ottosen , Civil Engineering, Technical University of Denmark, Kgs Lyngby, Denmark

Leakage of the chlorinated solvents PCE and TCE into limestone aquifers from contaminated overburden and the long-lasting back diffusion from the secondary source in the limestone matrix pose a severe risk for contamination of drinking water resources. Dechlorination of PCE and TCE in limestone often accumulates cis-DCE due to incomplete dechlorination in the limestone aquifers, as observed downgradient of a PCE and TCE DNAPL source area at Naverland in Denmark. A microcosm study with limestone core material and groundwater from the Naverland site source area spiked with PCE showed that enhanced reductive dechlorination (ERD) by the addition of donor and specific degraders (KB1® culture) can lead to complete dechlorination of PCE and TCE in the limestone aquifer, provided sufficient contact between specific degraders, donor and specific degraders, is obtained.

Advection-based delivery of donor and specific degraders is expected to result in spreading in fractures and other high permeability features only. Hence, contact between specific bacteria, donor, and contaminants in the contaminated matrix is expected to be limited by matrix diffusion and growth-based spreading of degraders causing very long remediation timeframes. Electrokinetics (EK) offers some unique transport processes, which can potentially overcome the diffusion limitations in the matrix. A novel technology combines ERD and EK for enhanced delivery. The combined technology (EK-BIO) has shown promising results in clay. Experimental work on EK-BIO in limestone was conducted in a laboratory setup with limestone cores. EK was demonstrated to be promising in establishing enhanced contact between the donor lactate, bacteria, and cis-DCE within the limestone matrix. Complete dechlorination is expected to take place in the matrix, since back diffusion limitations in the limestone matrix are overcome. This is essential for the overall time perspective of a remediation in limestone aquifers.

The research presented was funded by the Capital Region of Denmark.